

Chapter 1

Introduction

Check Your Understanding, Page 4:

1. The cars in the student parking lot.
2. He measured the car's model (categorical), year (quantitative), color (categorical), number of cylinders (quantitative), gas mileage (quantitative), weight (quantitative) and whether it has a navigation system (categorical).

Exercises, page 6:

- 1.1 Type of wood, type of water repellent, and paint color are categorical. Paint thickness and weathering time are quantitative.
- 1.2 Gender, race, and smoker status are categorical. Age, systolic blood pressure and level of calcium are quantitative.
- 1.3 (a) The individuals are AP[®] Statistics students who completed a questionnaire on the first day of class.
(b) The categorical variables are gender, handedness, and favorite type of music. The quantitative variables are height, homework time, and the total value of coins in a student's pocket.
(c) The highlighted individual is a female who is right handed. She is 58 inches tall, spends 60 minutes on homework, prefers Alternative music and had 76 cents in her pocket.
- 1.4 (a) The individuals are roller coasters that were opened in a recent year.
(b) The categorical variables are type and design. The quantitative variables are height, speed, and duration.
(c) The highlighted roller coaster is the Prowler, a wood, sit-down type coaster. Its height is 102.3 feet, its speed is 51.2 mph, and the duration of the ride is 150 seconds.
- 1.5 Student answers will vary; for comparison, recent *U.S. News* rankings have used quantitative variables such as retention rate, graduation rate, class sizes, faculty salaries, student-faculty ratio, percentage of faculty with highest degree in their fields, average ACT/SAT scores, average financial aid, and the percentage of alumni who give to the school. Examples of categorical variables would include region of the country and type of institution (2-year college, 4-year college, university).
- 1.6 Student answers will vary. Here is one possible answer: Two categorical variables are whether or not a student watches reality shows and how the student receives the television programming (antenna, cable, satellite, Internet). Two quantitative variables are the amount of time spent watching TV per week and the number of different channels viewed during a week.

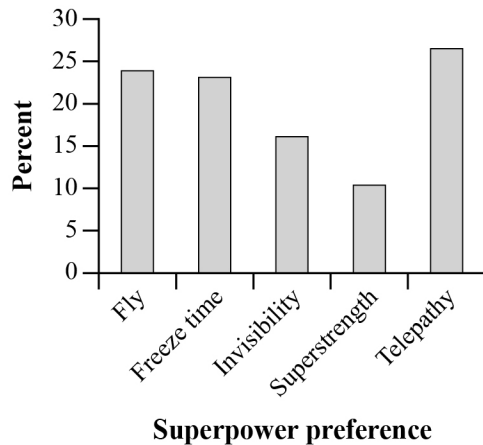
1.7 b

1.8 c

Section 1.1

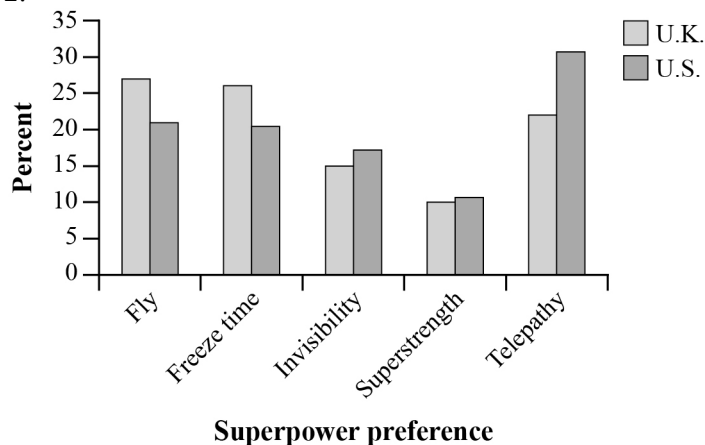
Check Your Understanding, page 14:

1. Fly: $99/415 = 23.9\%$, Freeze time: $96/415 = 23.1\%$, Invisibility: $67/415 = 16.1\%$, Superstrength: $43/415 = 10.4\%$, Telepathy: $110/415 = 26.5\%$.
2. A bar graph is shown below. It appears that telepathy, ability to fly, and ability to freeze time were the most popular choices, with about 25% of students choosing each one. Invisibility was the 4th most popular and superstrength was the least popular.



Check Your Understanding, page 18:

1. For the U.K. students: $54/200 = 27\%$ said fly, $52/200 = 26\%$ said freeze time, $30/200 = 15\%$ said invisibility, $20/200 = 10\%$ said superstrength, and $44/200 = 22\%$ said telepathy. For the U.S. students: $45/215 = 20.9\%$ said fly, $44/215 = 20.5\%$ said freeze time, $37/215 = 17.2\%$ said invisibility, $23/215 = 10.7\%$ said superstrength, and $66/215 = 30.7\%$ said telepathy.
- 2.

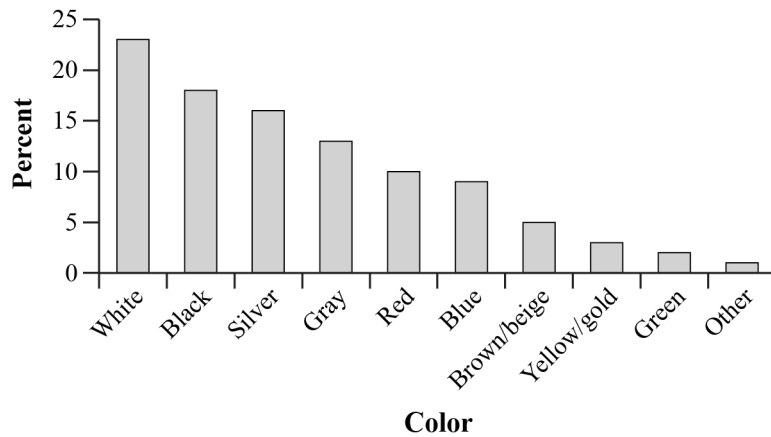


3. There is an association between country of origin and superpower preference. Students in the U.K. are more likely to choose flying and freezing time while students in the U.S. are more likely to choose invisibility or telepathy. Superstrength is about equally unpopular in both countries.

Exercises, page 20:

1.9 (a) The percent of cars with other colors is $100 - 23 - 18 - 16 - 13 - 10 - 9 - 5 - 3 - 2 = 1\%$.

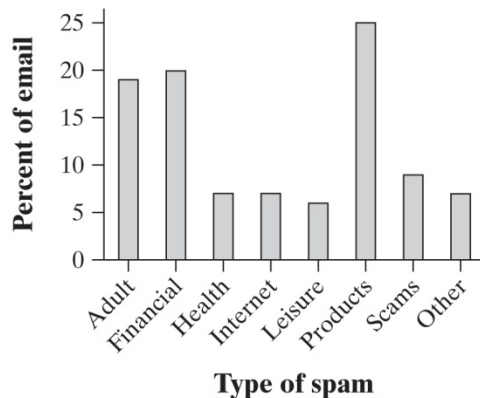
(b) A bar graph is given below.



(c) It would be appropriate to make a pie chart of these data (including the other category) because the numbers in the table refer to parts of a single whole.

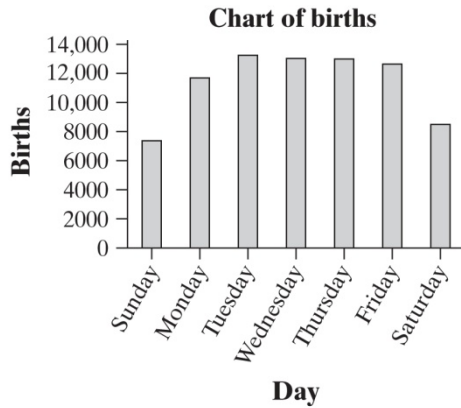
1.10 (a) The percent of spam that occur in the “other” category is $100 - 19 - 20 - 7 - 7 - 6 - 25 - 9 = 7\%$.

(b) A bar graph is given below.



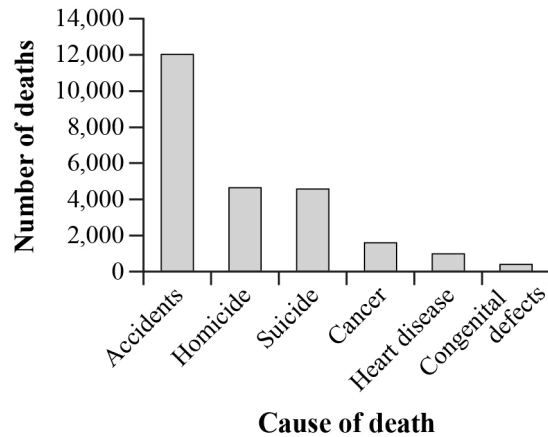
(c) It would be appropriate to make a pie chart of these data (including the other category) because the numbers in the table refer to parts of a single whole.

1.11 (a) A bar graph is given below. A pie chart would also be appropriate because the numbers in the table refer to parts of a single whole.



(b) Perhaps induced or C-section births are scheduled for weekdays so doctors don't have to work as much on the weekend.

1.12 (a) A bar graph is given below.



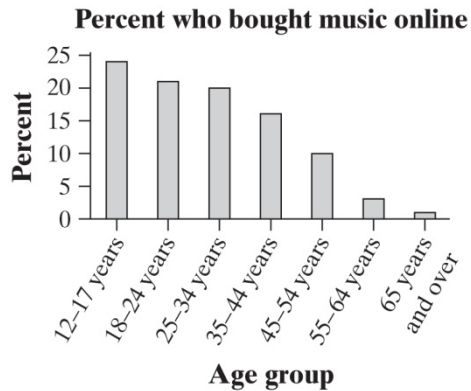
(b) You need to know the total number of deaths among people aged 15-24 in the U.S. so that you can figure out how many deaths would be categorized as "other."

1.13 Estimates will vary, but should be close to the actual reported percents: 63% Mexican, 9% Puerto Rican.

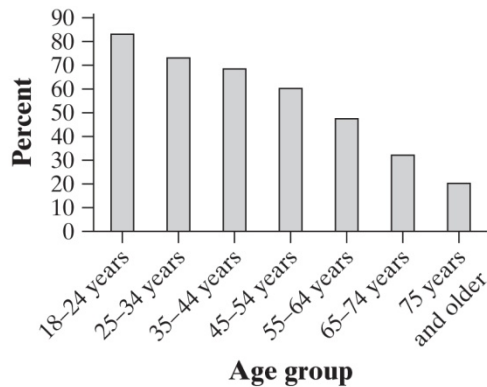
1.14 Estimates will vary but should be close to: 20% Business, 12% Social Science.

1.15 (a) A pie chart could not be used for these data because the given percents represent fractions of different age groups, rather than parts of a single whole.

(b) A bar graph is given below.



1.16 (a) A bar graph is given below. Movie attendance seems to drop off as people get older.

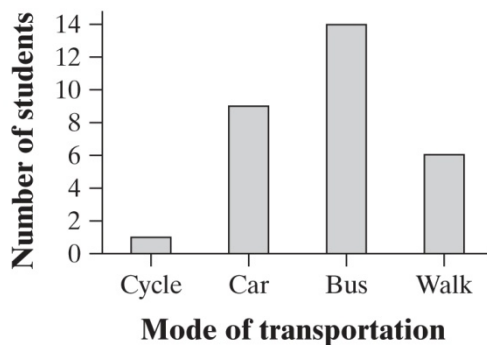


(b) A pie chart could not be used for these data because the given percents represent fractions of different age groups, rather than parts of a single whole.

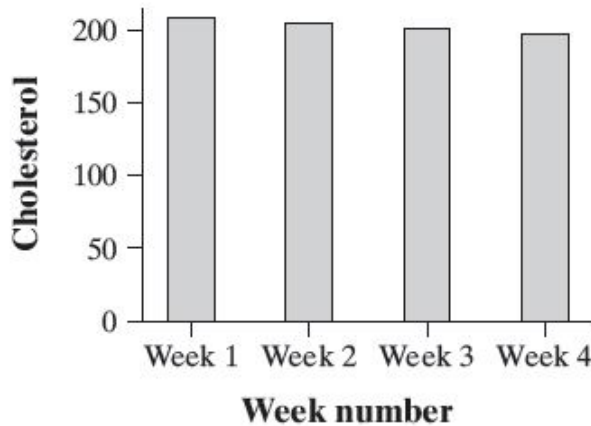
(c) To know what percentage of the audience is 18 to 24 years old, we need to know how many people are in each age group. The data provided only tell us what percentage of each age group has been to a movie in the last 12 months.

1.17 (a) The areas of the pictures should be proportional to the numbers of students they represent. As drawn, it appears that most of the students arrived by car but in reality most came by bus (14 took the bus, 9 came in cars).

(b) A bar graph is given below.



- 1.18 (a) The vertical scale does not begin at 0 which over-emphasizes the difference in cholesterol.
 (b) A bar graph is given below. The drop in cholesterol is much smaller than it appeared in the original graph.



- 1.19 (a) This table describes $20 + 7 + 9 + 29 + 25 + 43 = 133$ people, of which 36 were buyers of coffee filters made of recycled paper.
 (b) $49/133 = 36.8\%$ said “higher,” $32/133 = 24.1\%$ said “the same,” and $52/133 = 39.1\%$ said “lower.” Overall, $36.8 + 24.1 = 60.9\%$ of the members of the sample think the quality of the recycled product is the same or higher than the quality of other filters.

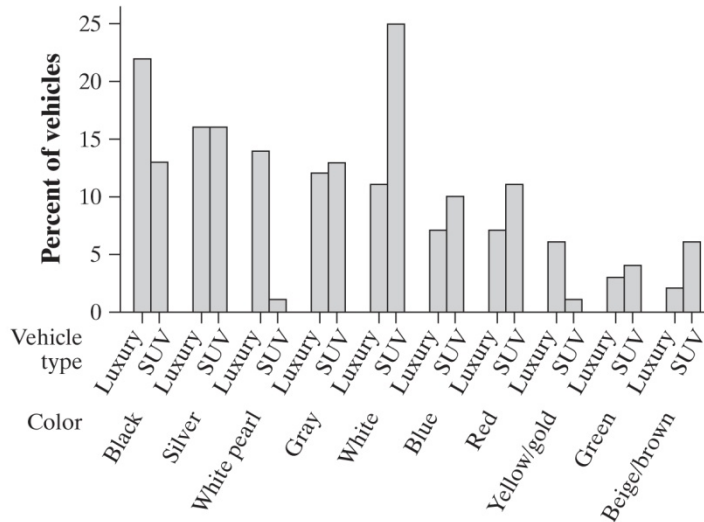
- 1.20 (a) The table describes $1168 + 188 + 1823 + 416 + 1380 + 400 = 5375$ students. The percentage of these students who smoke is $\frac{188 + 416 + 400}{5375} = \frac{1004}{5375} = 18.7\%$.
 (b) $1168 + 188 = 1356$, so $1356/5375 = 25.2\%$ of students have no parents who smoke; $1823 + 416 = 2239$, so $2239/5375 = 41.7\%$ have one parent who smokes; $1380 + 400 = 1780$, so $1780/5375 = 33.1\%$ have both parents who smoke.

- 1.21 For buyers, $20/36 = 55.6\%$ said higher, $7/36 = 19.4\%$ said the same, and $9/36 = 25\%$ said lower. For the nonbuyers, $29/97 = 29.9\%$ said higher, $25/97 = 25.8\%$ said the same, and $43/97 = 44.3\%$ said lower. We see that buyers are much more likely to consider recycled filters higher in quality than nonbuyers and much less likely to consider them lower in quality than nonbuyers.

- 1.22 For students with no parents who smoke, $1168/1356 = 86.1\%$ don’t smoke and $188/1356 = 13.9\%$ smoke. For students with one parent who smokes, $1823/2239 = 81.4\%$ don’t smoke and $416/2239 = 18.6\%$ smoke. For students with both parents who smoke, $1380/1780 = 77.5\%$ don’t smoke and $400/1780 = 22.5\%$ smoke. The conditional distributions reveal what many people expect—there is a relationship between the smoking behaviors of students and their parents. When the number of parents smoking goes from 0 to 1 to 2, the percentage of students who smoke increases as well.

- 1.23 Americans are much more likely to choose white/pearl and red than Europeans, while Europeans are much more likely to choose silver, black, or gray than Americans. Preferences for blue, beige/brown, green, and yellow/gold are about the same for Americans and Europeans.

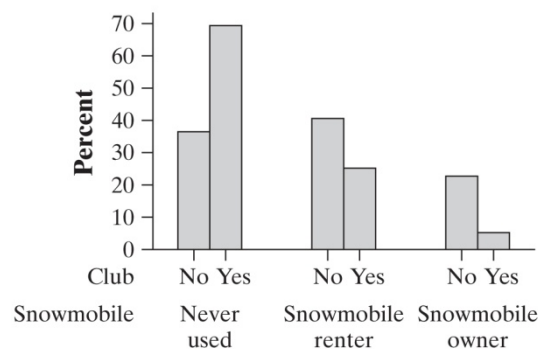
- 1.24 (a)



(b) Luxury car owners are more likely to choose black, white pearl, and yellow/gold than SUV, truck, and van owners. SUV, truck, and van owners are more likely to choose white, blue, red, and beige/brown than luxury car owners. Preference for silver, gray, and green are about the same for luxury car owners and SUV, truck, and van owners.

1.25 We suspect that belonging to an environmental club will reduce the chances that someone will use a snowmobile so we'll compare the conditional distributions of snowmobile use for those who belong to an environmental organization and for those who don't. Here is a table and a side-by-side bar graph comparing these distributions.

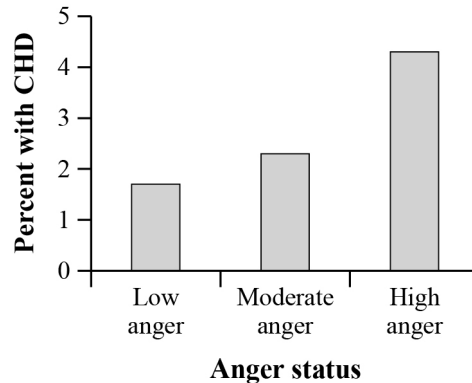
	Not a member	Member
Never used	445/1221 = 36.4%	212/305 = 69.5%
Snowmobile renter	497/1221 = 40.7%	77/305 = 25.2%
Snowmobile owner	279/1221 = 22.9%	16/305 = 5.2%



Based on these data, there is an association between environmental club membership and snowmobile use. The visitors who are members of an environmental club are much more likely to have never used a snowmobile than visitors who are not members of an environmental club. Those in an environmental club are less likely to have rented or owned a snowmobile than visitors who are not in an environmental club.

1.26 We suspect that people with different anger levels will have different rates of CHD, so we'll compare the conditional distributions of CHD for each anger level. Here is a table and a side-by-side bar graph comparing these distributions.

	Low anger	Moderate Anger	High Anger
CHD	53/3110 = 1.7%	110/4731 = 2.3%	27/633 = 4.3%
No CHD	3057/3110 = 98.3%	4621/4731 = 97.7%	606/633 = 95.7%



The data do support the study's conclusion about the relationship between anger and heart disease. The percent of the people in the study with CHD increases as the anger level increases.

1.27 d

1.28 b

1.29 d

1.30 d

1.31 b

1.32 d

1.33 d

1.34 c

1.35 Answers will vary. Two possible tables are given below.

10	40
50	0

30	20
30	20

1.36 (a) The individuals are vehicles.

(b) The variables are make/model (categorical), vehicle type (categorical), transmission type (categorical), number of cylinders (quantitative), city MPG (quantitative) and highway MPG (quantitative).